

***Macrothrix marthae*, a new species (Crustacea: Anomopoda: Macrothricidae), a highly specialized macrothricid from Mexico**

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Abstract.—*Macrothrix marthae* new species is described from a tropical epicontinental lagoon, near the gulf coast of Mexico. The structure of the second antenna resembles some taxa related to the *Macrothrix triserialis*-group, but mostly to the South-American *Macrothrix superaculeata* (Smirnov, 1982). However, parthenogenetic females of *M. marthae* are characterized by both morphological differences and strong specialization for scraping in the thoracic limbs I–V. Some of these distinguishing characters are: internal distal lobe of trunk limb I with three strongly pectinate setae, limbs II, III, and V with modified setae bearing well-developed pectens. The postabdomen has small spines, with no lobe formation. The new species was found to be associated with water hyacinth roots, and the adaptations observed are thought to be used to scrape efficiently organic matter from these roots.

Recently, several new species of cladocerans have been found in Mexico. Among them, three new species of *Macrothrix*, *M. mexicanus* Ciroso-Pérez, Silva-Briano & Elías-Gutiérrez, 1996, *M. smirnovi* Ciroso-Pérez & Elías-Gutiérrez, 1997 and *M. sierrafriatensis* Silva-Briano, Quang Dieu & Dumont, 1999, were described from high-altitude aquatic systems, located more than 2000 m above sea level. Our examination of lowland lakes and ponds of southeast Mexico yielded specimens of a new species of *Macrothrix*. These surveys in tropical zones of Mexico have made known several new species of freshwater crustaceans such as copepods (e.g., Fiers et al. 1996, Suárez-Morales & Elías-Gutiérrez 2000) and cladocerans (e.g., Elías-Gutiérrez & Suárez-Morales 1999). These new records resulted from studies in zones and environments such as temporary small ponds and periphytic habitats that were overlooked by specialists until the last decade.

Dumont (1994) suggested that in the tropical areas of the world there is an underestimation of the cladoceran species and predicted that most of the new taxa described will be from these regions. In this paper a new macrothricid cladoceran is described from the coastal plateau of southeastern Mexico, in an aquatic system associated with the Usumacinta river.

Materials and Methods

Samples were collected from water hyacinths by filtering the water from the roots with a 50 μm mesh plankton net; the material was then fixed with sugar formaldehyde (Haney & Hall 1973).

All measurements of the specimens were made following Smirnov's (1971) criteria. Structures were dissected with tungsten needles and then mounted in a glycerin-formaldehyde mixture for a detailed analysis. Drawings were made with the aid of a

camera lucida attached to a Zeiss microscope. Several females were dehydrated in a series of ethanol-water solution from 15% to 100%. After this, animals were dried by the critical point method, mounted, gold-coated, and examined with a Topcon SM-510 scanning electron microscope (SEM) at 10–15 kV. Descriptions were based on both SEM photographs and camera lucida drawings.

Macrothrix marthae, new species

Figs. 1–24

Material.—Holotype: One adult ovigerous female (total length 0.52 mm, height 0.37 mm), preserved in 4% formaldehyde solution, with a drop of glycerol. Vial deposited in The Natural History Museum (NHM), London (1999.1882), 12 January 1998. Paratypes: One ehippial female, in 4% formaldehyde solution, with a drop of glycerol added, NHM 1999.1883, 12 January 1998. Two parthenogenetic females in same medium, Zoological Museum of Moscow University, ZMMU, 12 January 1998. Two adult parthenogenetic females, each dissected and mounted on a slide in glycerine, sealed with DePeX mounting medium. Three parthenogenetic females in formaldehyde solution, deposited at El Colegio de la Frontera Sur (ECO-CH-ZOO 783, 784 and 785).

All remaining specimens and original samples deposited in El Colegio de la Frontera Sur, Chetumal, Mexico.

Type locality and habitat.—Playa del Pozo Lake, located near the Villahermosa city airport, Tabasco State, Mexico (18°00'41"N, 92°17'11"W), 12 Jan 1998: Altitude 10 m above sea level, water temperature of 30.3 °C (air temperature 29.3 °C), pH 6.96, depth 1.66 m, and Secchi disk transparency 0.58 m. *Macrothrix spinosa* King, 1853 was found at the same site.

Etymology.—The species name honors Martha Elena Valdéz-Moreno (wife of Elías-Gutiérrez), for her strong support and understanding to his cladoceran studies.

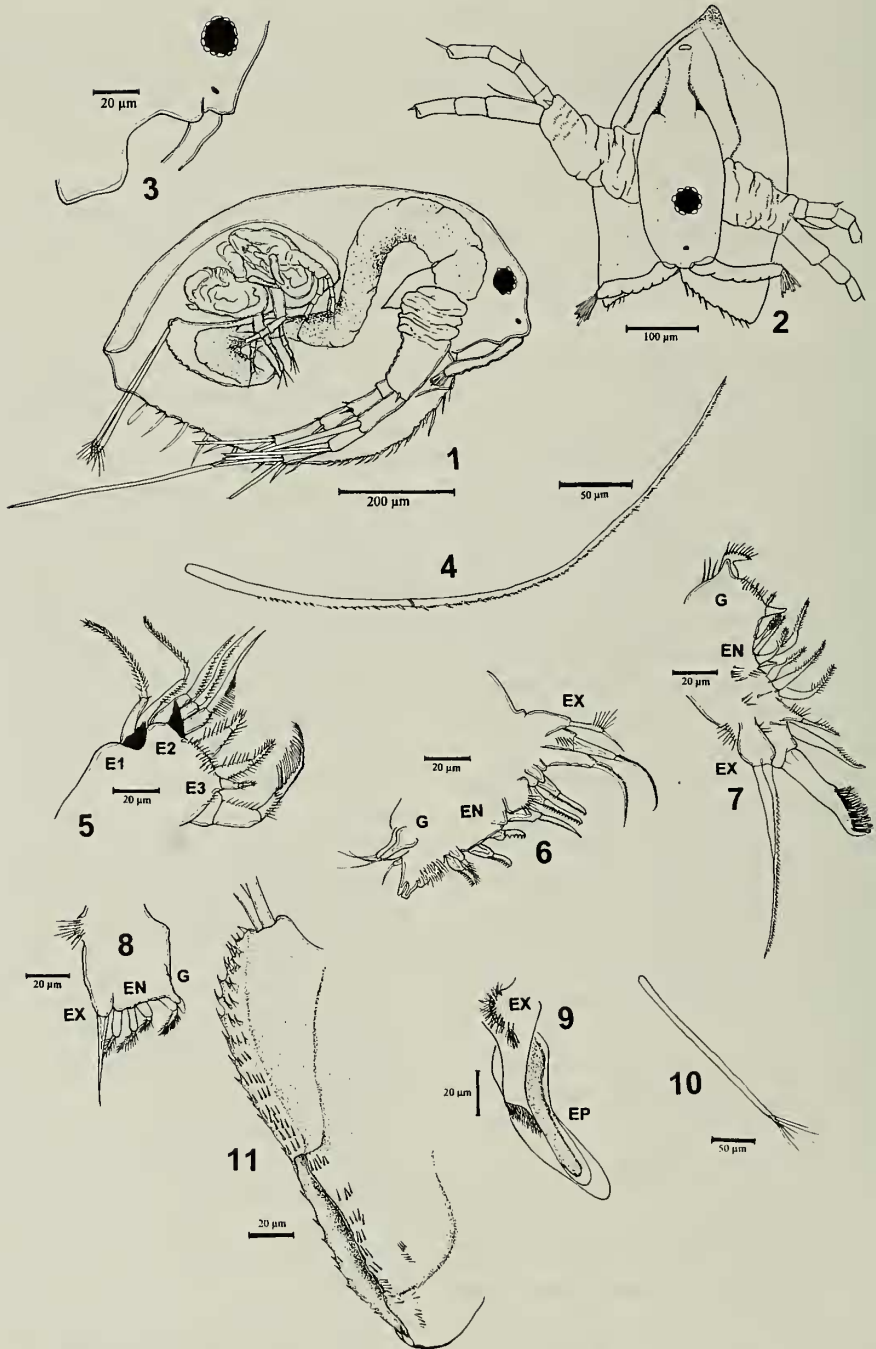
Diagnosis.—This species is characterized by the arrangement of antennal armature, which is one spine on the distal edge of segments 2 and 4 of the endopod branch, plus an accessory spine on segments 2 and 3, about a half length of the other spines; strongly pectenate setae on limbs I, III and V, not seen in any other known *Macrothrix*; postabdomen with no lobe formation, pre-anal postabdominal spinules subequal in size, and arranged in a stripe of several rows. Claws small and pecten-like. Distal segment of postabdominal seta natatoria very short, more than 17 times shorter than proximal segment.

Measurements.—Mature parthenogenetic females: Total length of the body from 0.44 to 0.6 mm, height from 0.27 to 0.39 mm.

Description of parthenogenetic female.—Shape and shell: Body ovoid (length: maximum height = 1.40–1.63). Dorsal margin curved from supraocular region to posterior-dorsal angle (Fig. 1); a pointed keel at the top of the shell (Fig. 2). Dorsal margin of shell without serration, ventral margin serrated, mainly on the anterior half. Two rows of movable different-sized spines inserted along the submarginal edge on the posterior half. External row of sparse leaf-like spines of about the same size, directed outwards. Inner row of smaller spines directed inwards. Each one of the latter alternating with every leaf-like spine. Entire surface of shell dotted and striated with a polygonal pattern.

Head: Evenly rounded, with noticeable supraocular bulge tapering to rostral region (Fig. 1). Frontal part of rostrum trilobed, each lobe subequal in size. Lateral ridges absent. Head pore large and subcircular. Ventral margin of head, in lateral view, with lobe behind insertion of antennule (Fig. 3). Labrum small, triangular, continuing ventral margin of head (Fig. 3). Labral apex blunt. Compound eye located close to midpoint between dorsal and ventral edges. Ocellus close to rostral apex, about 5 times smaller than compound eye.

First antenna (Figs. 12–13): Rod-shaped



Figs. 1–11. *Macrothrix marthae*, new species, Playa del Pozo, Tabasco State, Mexico. Parthenogenetic female. 1, lateral view (distal segments of antennal setae are omitted); 2, frontal view; 3, ventral margin of the head with labrum; 4, seta on first endopodal segment, proximal and distal segments; 5, right first trunk limb, endites 1–3 (from left to right side; outer distal lobe and inner distal lobe are omitted); 6, left trunk limb II, lateral view (in the upper part is the exopod with a soft seta armed with long, tiny setules); 7, right trunk limb III, lateral view (in the lower part is the exopod with two long setae); 8, right trunk limb IV, lateral view (to the left is the exopod with a seta); 9, left trunk limb V, lateral view; 10, seta natoria of postabdomen; 11, Postabdomen. Abbreviations: E1, endite 1; E2, endite 2; E3, endite 3; EN, endopodite; EX, exopodite; G, gnathobase; EP, epipodite.

(length:width = 5.2–5.3) inserted subapically, not dilated distally, with single ventrolateral basal sensory seta. Distally, relatively long spines surround insertion of aesthetascs. Laterally, the entire surface has 8–10 transverse rows of small spines arranged in groups of 3–5 (Fig. 12). Medially, several groups of two spines, each distributed over the whole surface (Fig. 13). Nine aesthetascs on distal end, all of them unequal in length (Figs. 12 and 13).

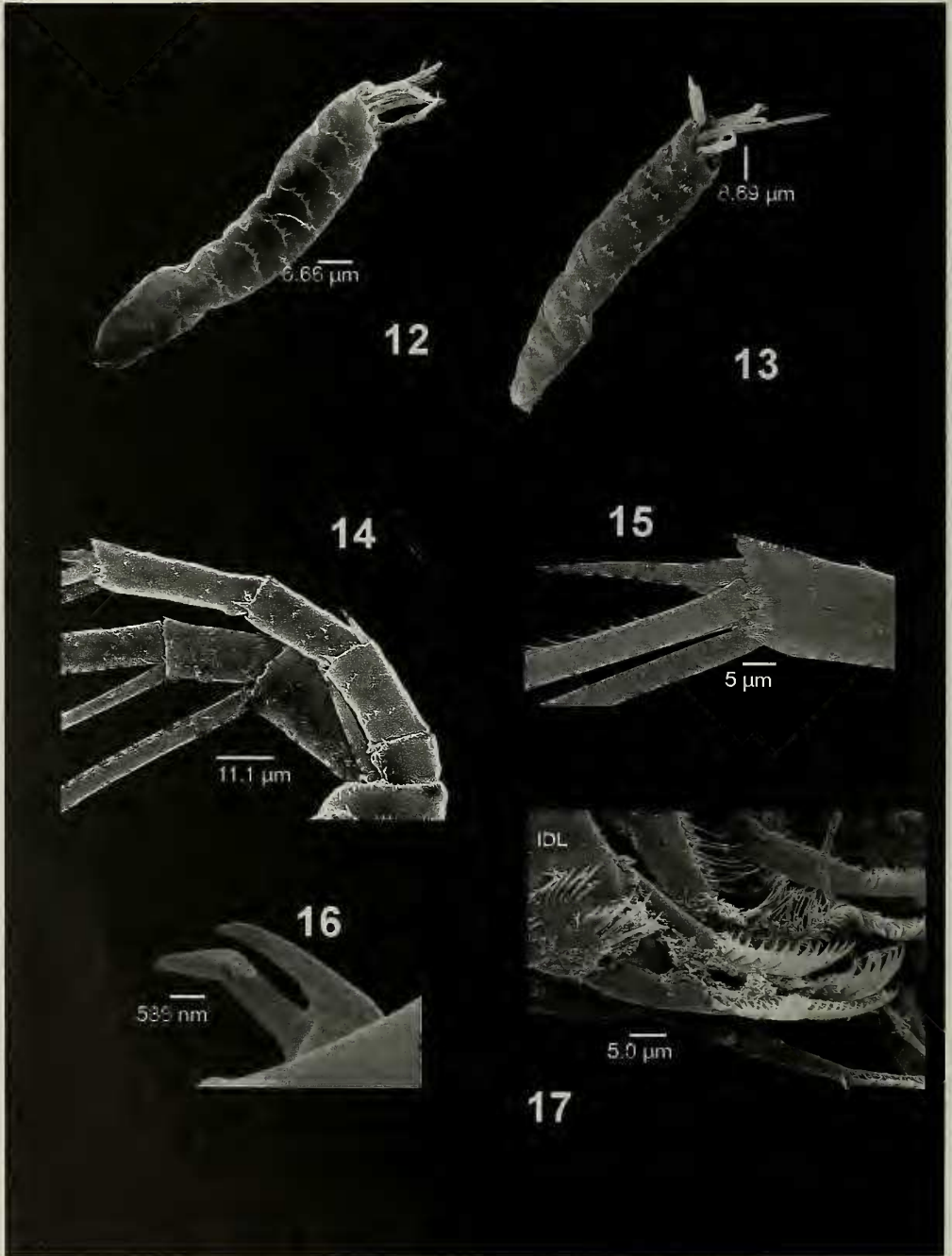
Second antenna (Figs. 14–15): Coxa massive; as in other macrothricids, basal region appears annulated with several folds, with several rows of tiny denticles on lateral margin; one soft seta on middle of medial apical region. Lateral surface of distal portion with a small spine. Swimming setae 0-0-1-3/1-1-3, spines 0-2-1-1/0-0-1. All exopodal setae carry spines on distal segment, except for innermost apical member. Exopod with one spine on distal edge of segments 2 and 4. Internal spine on segments 2 and 3, both subequal in length (Fig. 14). Exopod tip with two different sized groups of spinules. Large ones arranged in groups of 4–5 members, smaller ones in groups of 5–7. Surface of all antennal segments with rows of fine scale-like spinules. First endopodal segment with the longest seta (Fig. 4). This seta is bisegmented (distal: proximal = 1.8), stout, sclerotized, and long (body length:seta length = 1.18–1.34). Convex margin armed with fine spinules on the first $\frac{3}{4}$ of proximal segment, followed in the last quarter by alternating stronger spines and groups of 3–5 fine spinules. This arrangement continues along distal segment, but groups of spines decrease in size distally. Second and third endopodal segments covered by rows of fine spinules.

Trunk limb I (Figs. 5, 16–19): Exopod (outer distal lobe, ODL) slender, bearing an apical seta with chitinized setules along distal third (Fig. 18). Internal distal lobe (IDL) with three strongly pectenate setae, unequal in length (Figs. 17, 18). The two longest ones with second half pectinated. Remaining one with the stronger pecten reduced at

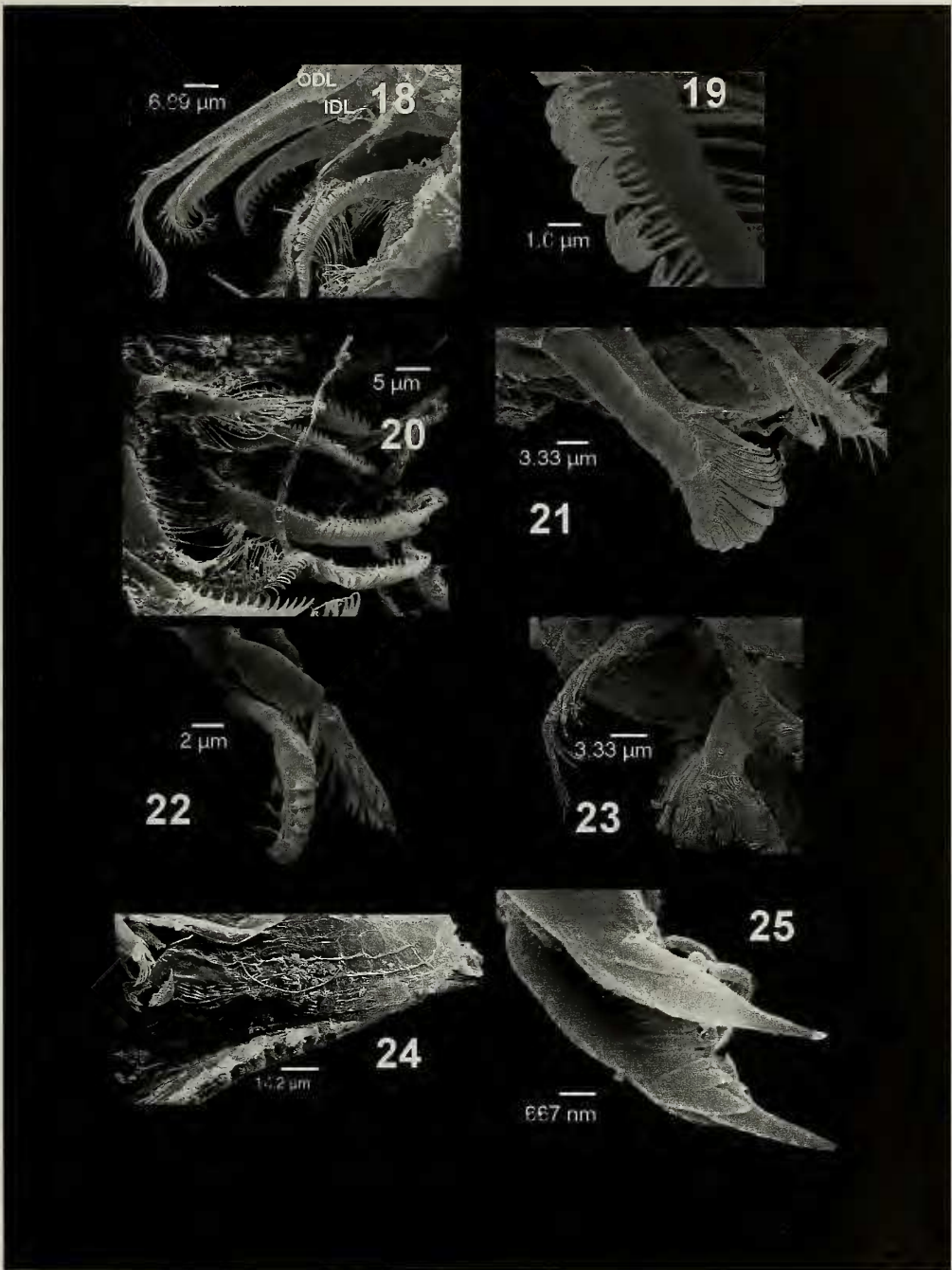
distal third. Posterior surface of IDL with groups of strongly chitinized setae (Fig. 17). Endite 3 with four setae, different in size, two of them equal in length, bisegmented; shortest one segmented, densely pilose at tip. Longest one with peculiar armature formed by approximately six short setules fused into a plate, with successive plates aligned along one margin of the seta (Figs. 18, 19). Opposite side to these plates armed with long setules (Fig. 19). Endite 2 with three bisegmented setae, two of them setulated along distal section and with row of sparse setules on proximal joint. Remaining one with setules only on proximal half of second segment, increasing abruptly in size and decreasing gradually toward tip. Endite 1 with two plumose setae, both of them bisegmented (Fig. 5). Inner spines on endite 1 and 2 with furrow on one of the two teeth where the opposite teeth can be engaged (Figs. 5, 16).

Trunk limb II (Figs. 6, 20): Exopod reduced, with apical soft seta with long, tiny setules at the middle. Endopod with row of eight scrapers, six proximal similar in structure, with a distinct base, and distally with a pecten of strong, sclerotized teeth (Fig. 6). Scrapers 1–3 shorter than 4–6. Scrapers 7 and 8 long, bisegmented, with second segment densely setulate, with triangle-shaped lobe densely ciliated on the apex, located on external surface of the endopod, near the insertion of scrapers 4 and 5. Adjacent to scraper 1, also on the external margin, there is a bisegmented seta, densely pilose on distal section. Gnathobase with reduced filtering comb composed by four small setae, and a probable receptor represented by a reduced seta-like structure.

Trunk limb III (Figs. 7, 21–22): Exopod with two long setae unilaterally setulated. Endopod with distalmost seta stout, sclerotized, with strong pecten developed on distal third (Fig. 21), followed by two smaller setae (Fig. 22), each with a strong brush-like pecten on distal part. External margin with one small setulated seta. Internal armature with seven unequal setulated setae.



Figs 12–17. *Macrothrix marthae*, new species, Playa del Pozo, Tabasco State, Mexico. Parthenogenetic female. 12, first antenna, lateral side; 13, first antenna, medial side; 14, second antenna, medial view; 15, tip of exopod, medial side; 16, trunk limb I, inner spine of endite I; 17, trunk limb I, setae on inner distal lobe (IDL).



Figs. 18–25. *Macrothrix marthae*, new species, Playa del Pozo, Tabasco State, Mexico. Parthenogenetic female. 18, trunk limb I, setae on outer distal lobe (upper side) and inner distal lobe (in the middle). At the lower part is seen the longest seta from endite 3, with plate-like projections; 19, detail of longest seta from endite 3, showing plate-like projections forming successive transverse rows; 20, trunk limb II, scrapers 3–6; 21, trunk limb III, distalmost seta with a strong pecten; 22, trunk limb III, smaller setae after distalmost seta; 23 trunk limb V, strong pectinated seta; 24, postabdomen, dorsal view; 25, postabdominal claws.

Gnathobase sub-rectangular, with two finger-like lobes on each corner and a strongly setulated "L"-like seta on proximal part (Fig. 7).

Trunk limb IV (Fig. 8): Much reduced. One apical naked seta on exopod. Armature consisting of three bisegmented subequal setae, densely pilose plus one tubular sensillum on proximal part. Gnathobase reduced, formed by a densely setose seta and a finger-like lobe. One of the sides of the former armed with more strongly chitinized setules.

Trunk limb V (Figs. 9, 23): Exopod reduced, with small densely pilose seta and a strong, well-differentiated pectinated seta (Fig. 23). Epipodite large, ovoid.

Postabdomen (Figs. 11, 24): Ovoid in lateral view (body length:postabdomen length = 2.36–3.23). Ventral margin somewhat convex, dorsal margin more or less straight, not bilobed, anus subterminal. Anal region bordered on both sides by dorsal stripe of needle-like spinules arranged in several transverse rows (ca. 8–10) which are subequal in length. These two stripes continue proximally into one medial stripe with similar arrangement, composed of 15–25 rows. Claws small, sclerotized, curved, with a lateral face armed by one notable spine, medial margin with a pecten, obliquely arranged (Fig. 25). Claw ornaments visible only with SEM. The setae natatoria (Fig. 10) arising from a sclerotized portion, located proximally on the postabdomen, distal segment much shorter than proximal (proximal segment:distal segment = 17–18), with long, bristle-like setae.

Discussion

Macrothrix marthae has a unique combination of features, which make it difficult to include in any of the species-groups currently recognized. The most significant feature of this new taxon is the strong specialization for scraping, represented by setae modified as scrapers on limbs I, III, and

V as described. No similar structures are found in any other known *Macrothrix*.

However, considering the first antenna structure, its largest seta, and the features of the natatory setae natatoria, this species could be related to the *M. triserialis*-group as is *M. smirnovi*, a species recently described from highlands of Mexico (Ciros-Pérez & Elías-Gutiérrez 1997). *Macrothrix marthae* seems not to have the same ability to grasp objects as described by Fryer (1974) for *M. triserialis*. The rake-like function of the same setae in *M. laticornis* (Fischer, 1851) seems to be stronger and more specialized in *M. marthae*, as can be inferred by its strong pectens.

The *triserialis*-group also includes a species from South America, *M. superaculeata* (Smirnov, 1982) (in Brandorff, 1982), which seems to be the most closely related species to the Mexican species. This is suggested by the presence of several features including the more specialized arrangement of the thoracic limbs to rake rather than to grasp and also by the similarities on the armature of the antennae.

Macrothrix marthae has similarities with other species: the arrangement of the first antennae, the small lobe on the ventral margin of the head, the postabdomen, and the seta natatoria are similar to those of *Macrothrix capensis* (Sars, 1916) which, however, lacks the specialized setae on limbs I, III, and V. A species from Australia, *M. indistincta* Smirnov, 1992 has only one pectinated seta on limb III, and a short distal segment of the seta natatoria, but all the other features of the first antenna, second antenna, and postabdomen are quite different from *M. marthae*.

Other species with a short distal segment of the setae natatoria are *Macrothrix flabeligera* Smirnov, 1992 and *Macrothrix pectinata* (Smirnov, 1976a) from Australia, and *Macrothrix odiosa* Gurney, 1907 from Southeastern Asia. However, as described for *Macrothrix indistincta*, they are quite different in other characters, such as limb

I–V structure, first antenna and postabdomen, so they can be easily separated.

Macrothrix paulensis (Sars, 1900) and *Macrothrix gauthieri* Smirnov, 1976b have accessory spines on the antennal exopod, but differ from *M. marthae* on the following features: the two former have large spines along the first antenna, also the structure of postabdomen and the limbs (Brandorff et al. 1982, Smirnov 1992) are quite different from *M. marthae*.

The adaptations described for *M. marthae* seem to be related to a strictly epiphytic habit. The species was found abundantly associated with the roots of water hyacinth. It seems that this species is a true scraper of the organic matter adhered to the hard substrata represented by the roots instead of the flocculent detritus preferred by other macrothricids (Fryer 1974).

Most surveys on cladocerans omit the fauna associated to the aquatic vegetation, and it is possible that many new species, mainly from the tropics, will be discovered with adequate sampling techniques to collect this specialized fauna.

Finally, the report of this new species increases the number of *Macrothrix* species known from Mexico to thirteen (Silva-Briano 1998, Elías-Gutiérrez et al. 1999, Silva-Briano et al. 1999). Out of these, seven are known to be restricted to south-central Mexico, thus suggesting limited distributional ranges of these forms. Evidence suggests that some species are confined to high altitude systems (e.g., *M. smirnovi* and *M. mexicanus*) and others to lowlands, such as *M. cf. triserialis* sensu Silva-Briano (1998) and *M. marthae*. Other species recorded from this region need further revision (Elías-Gutiérrez et al. 1999), mainly in the structural details of thoracic limbs, first antennae, and postabdomen.

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